

## Revision of the Ant Genus *Strumigenys* Fr. Smith (Hymenoptera: Formicidae) of Taiwan

Chung-Chi Lin and Wen-Jer Wu\* Department of Plant Pathology and Entomology, National Taiwan University, Taipei, Taiwan, R.O.C.

### ABSTRACT

The genus *Strumigenys* Fr. Smith of Taiwan is revised. Ten species are recognized, of which 5 are new to science and 1 is newly recorded: *S. formosensis* Forel, *S. godeffroyi* Mayr (new record), *S. hispida* sp. nov., *S. lacunosa* sp. nov., *S. lichiaensis* sp. nov., *S. liukueiensis* Terayama & Kubota, *S. minutula* Terayama & Kubota, *S. nanzanensis* sp. nov., *S. solifontis* Brown and *S. trada* sp. nov. A key to the workers and females is presented.

**Key words:** Hymenoptera, Formicidae, Dacetoniini, *Strumigenys*, Taiwan.

### Introduction

The ant genus *Strumigenys* Fr. Smith, 1860, belonging to the tribe Dacetoniini in the subfamily Myrmicinae, is represented by 167 described species distributed in all zoogeographical regions from the tropical to the temperate zones of the world (Bolton, 1995). Modern taxonomic understanding of *Strumigenys* depends almost entirely upon the works by Brown (1948-1973), who sorted the great diversity of forms previously included in the genus and completed a large number of descriptive, faunistic and revisionary works on *Strumigenys* and its allies, on a world basis.

The first description of Taiwanese *Strumigenys* was that of Forel (1912), who recognized *Strumigenys feae* var. *formosensis* from Peinan, Taitung Hsien in the southeastern part of the island. In 1949, Brown raised Forel's variety to species status, *S. formosensis*. Recently,

Terayama and Kubota (1989) described 2 new species, *S. minutula* and *S. liukueiensis*, and recorded *S. solifontis* for the 1st time. Thus 4 species of the genus have hitherto been found in Taiwan. A key to the Taiwanese species of *Strumigenys* was also provided by Terayama and Kubota (1989).

In this paper, 5 new species (*S. hispida* sp. nov., *S. lacunosa* sp. nov., *S. lichiaensis* sp. nov., *S. nanzanensis* sp. nov. and *S. trada* sp. nov.) and 1 newly recorded species (*S. godeffroyi*) are added to the fauna of Taiwan.

The following abbreviations are used for the institutions and collectors in the lists of materials examined: National Taiwan University (NTU), Taiwan Agricultural Research Institute (TARI), C. C. Lin (CCL), C. Y. Lee (CYL), I. S. Shu (ISS) and Y. C. Shiao (YCS).

### Measurements and indices

Terminology used herein mainly fol-

\*Correspondence reprint request address

lows that in Terayama and Kubota (1989). Their measurements are as in Figs. 1-2.

Cephalic index (CI).  $HW \times 100 / HL$

Frontal carinal distance (FCD). Maximum distance between the frontal carinae, measured in full face (dorsal) view.

Frontal carinal index (FCI).  $FCD \times 100 / HW$

Head length (HL). Maximum length of head excluding mandibles, in full face view.

Head width (HW). The maximum width of the head in full face view.

Mandibular length (ML). The straight-line length of the mandible, measured in the same plane for which the HL measurement is taken, from the mandibular apex to the transverse through the anteriormost point of the clypeal margin.

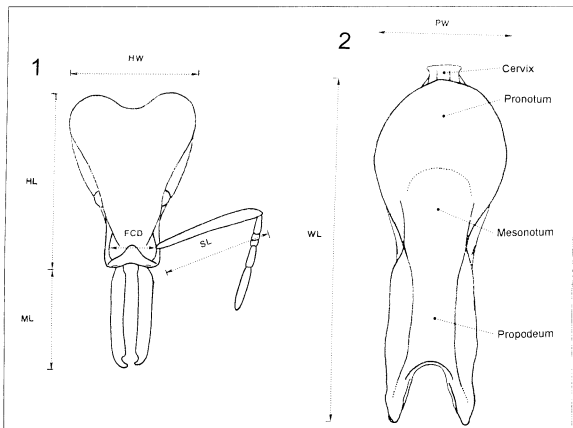
Mandibular index (MI).  $ML \times 100 / HL$

Mesosoma index (MSI).  $PW \times 100 / WL$

Pronotum width (PW). The maximum width of the pronotum in dorsal view.

Scape index (SI).  $SL \times 100 / HW$

Scape length (SL). The maximum straight-line length of the antennal scape excluding the basal constriction.



Figs. 1-2. 1. Head of *Strumigenys* Fr. Smith worker in full face view, illustrating the measurement of frontal carinal distance (FCD), head length (HL), head width (HW), mandibular length (ML) and scape length (SL). 2. Mesosoma of *Strumigenys* Fr. Smith worker in dorsal view, illustrating the measurement of pronotum width (PW) and Weber's length of mesosoma (WL).

tion or neck close to the condylar bulb.

Total length (TL). The total outstretched length of the ant from mandibular apex to the gastral apex.

Weber's length of mesosoma (WL). The diagonal length of the mesosoma in profile from the point at which the pronotum meets the cervical shield to the posterior base of the meta-pleuron.

## ***Strumigenys* Fr. Smith**

*Strumigenys* Fr. Smith, 1860. J. Entomol.

1: 72. Type-species: *Strumigenys mandibularis* Fr. Smith, 1860: 72, by monotypy.

*Labidogenys* Roger, 1862. Berl. Entomol. Zeit. 6: 249. Type-species: *Labidogenys lyroessa* Roger, 1862: 251, pl. 1, fig. 17, by monotypy. (Synonymy by Brown, 1959. Psyche 66: 38)

*Pyramica* Roger, 1862. Berl. Entomol. Zeit. 6: 251. Type-species: *Pyramica gundlachi* Roger, 1862: 253, pl. 1, fig. 18, by monotypy. (Synonymy by Brown, 1959. Psyche 66: 37)

*Proscopomyrmex* Patrizi, 1946. Boll. Entomol. Univer. Bologna 15: 294. Type-species: *Proscopomyrmex londianensis* Patrizi, 1946: 295, fig 1, 2, by monotypy. (Synonymy by Brown, 1949. Mushi 20: 15)

*Eneria* Donisthorpe, 1948. Ann. Mag. Nat. Hist. 14: 598. Type-species: *Eneria excisa* Donisthorpe, 1948: 598, fig. 1 (= *Strumigenys lorae* Emery), by original designation. (Synonymy by Brown, 1949. Mushi 20: 15)

All the Taiwanese species of the genus *Strumigenys* belong to the *godeffroyi*-group in Brown (1959). This species-group differs from other groups by the following combination of characters: no preocular notch in the ventrolateral margin of head; mandibles slender, sickle- or hook-like at apex, with a pair of

spiniform preapical teeth or reduced; apical fork with 2, 3 or 4 spiniform teeth; presence of long projecting fine hairs on the dorsal (outer) surface of the hind tibia and basitarsus; spongiform appendages on propodeum, petiole and post-petiole.

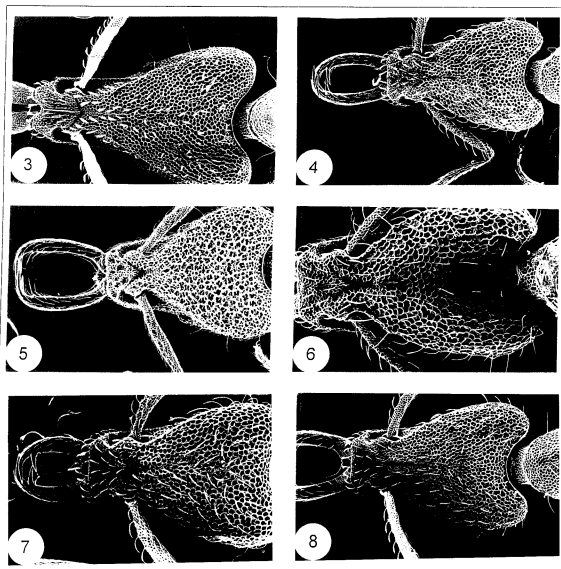
## **Key to the species of *Strumigenys* in Taiwan**

1. Anterior clypeal margin deeply concave medially (Fig. 3) ..... *S. formosensis* Forel  
— Anterior clypeal margin transverse (Figs. 4-8) ..... 2
2. Dorsolateral margin of head behind level of eye with 1 or more laterally projecting flagellate hairs; simple hairs may be present ..... 3  
— Dorsolateral margin of head behind level of eye without laterally projecting flagellate hairs; simple hairs may be present ..... 7
3. Head and mesosoma with flocculent hairs and lacunose sculpture (Fig. 5); head dorsolaterally with 3 pairs of long flagellate hairs (Fig. 20); mandible with a pair of spiniform preapical teeth or reduced (Figs. 5, 20); apical fork with an intercalary denticle between spiniform teeth; propodeal teeth acute and well developed ..... *S. lacunosa* sp. nov.  
— Head with spatulate hairs (Figs. 4, 7, 8); head dorsolaterally with 2 pairs of long flagellate hairs at most; mandible with a pair of acute spiniform preapical teeth, apical fork with 1 or 2 intercalary denticle between spiniform teeth; propodeal teeth spongiform ..... 4
4. First gastral tergite with 5 pairs of long flagellate hairs at most (Fig. 36); dorsolateral border of head posteriorly without erect hair (Fig. 35) ..... 5  
— First gastral tergite with numerous, long flagellate hairs (Fig. 31); dorsolateral border of head posteriorly with 3 pairs of erect hairs at least

- (Fig. 30).....6
5. Medium species, TL 2.20-2.44 mm; mandible relatively long,  $MI > 45$ , straight in full face view; propodeum smooth and shining in most part; eye with 6 ommatidia.....*S. trada* sp. nov.
- Smaller species, TL 1.70-1.96 mm; mandible relatively short,  $MI < 37$ , arcuate

in full face view (Fig. 7); propodeum microreticulate; eye consisting of 9-1 ommatidia.....*S. minutula* Terayama & Kubota

6. Dorsum of promesonotum with numerous, short curved hairs (Fig. 13); size relatively small, TL 2.20-2.22 mm; eye relatively large, consisting of 28-2



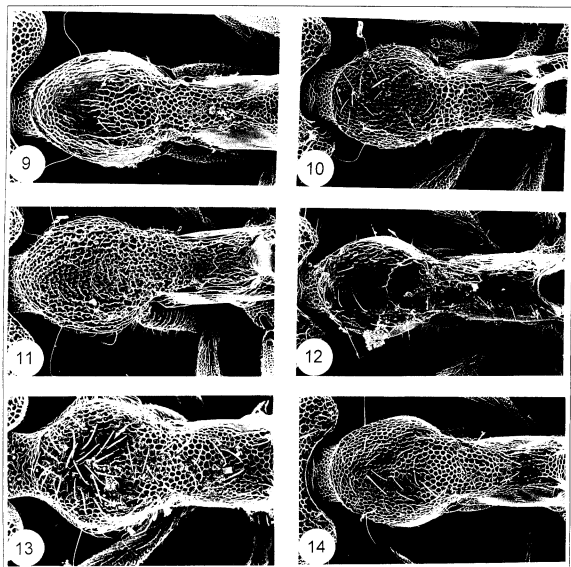
Figs. 3-8. Heads in dorsal view. 3, *Strumigenys formosensis* Forel; 4, *S. godeffroyi* Mayr; 5, *S. lacunosa* sp. nov.; 6, *S. liukueiensis* Terayama & Kubota; 7, *S. minutula* Terayama & Kubota; 8, *S. solifontis* Brown.

ommatidia; in female, mesosoma in profile with scutum convex (Fig. 34)·····

- Dorsum of promesonotum with few short curved hairs (Fig. 10); size relatively medium, TL 2.36-2.44 mm; eye relatively small, consisting of 10-13 ommatidia; in female, mesosoma in

profile with scutum even·····

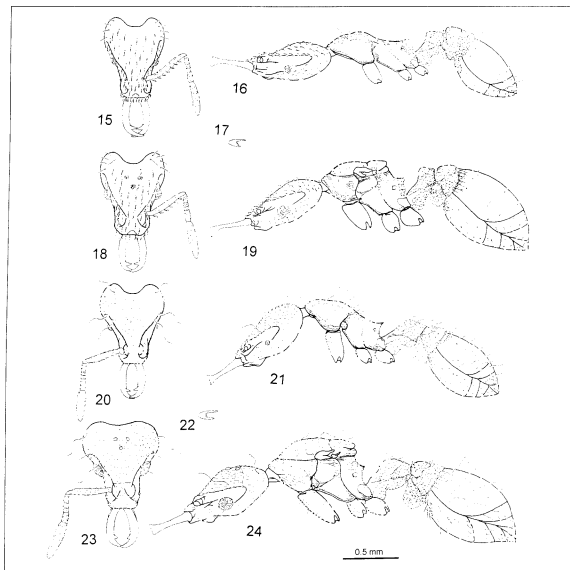
- *S. godeffroyi* Mayr
- 7. First gastral tergite with numerous simple erect hairs (Fig. 26)·····8
- First gastral tergite with long flagellate hairs, without simple erect hairs (Fig. 16)·····9
- 8. Cephalic dorsum with numerous long



Figs. 9-14. Mesosoma in dorsal view: 9, *Strumigenys formosensis* Forel, 10, *S. godeffroyi* Mayr, 11, *S. lacunosa* sp. nov.; 12, *S. liukueiensis* Terayama & Kubota, 13, *S. nanzanensis* sp. nov.; 14, *S. solifontis* Brown.

erect hairs (Fig. 6); dorsal margin of antennal scrobe with long erect hairs; dorsum of mesosoma with 8 pairs of long erect hairs at least (Fig. 12); larger species, TL 2.5-2.7 mm ..... *S. liukueiensis* Terayama & Kubota

— Cephalic dorsum with erect hairs only in posterolateral area (Fig. 25); dorsal margin of antennal scrobe with short narrowly spatulate hairs; dorsum of mesosoma with 6 pairs of long erect hairs at most; smaller species, TL 2.10



Figs. 15-24. 15-19. *Strumigenys hispidus* sp. nov.; 15, head, full face view, worker; 16, profile, worker; 17, apical fork of mandible, end-on view, worker; 18, head, full face view, female; 19, profile, female. 20-24. *Strumigenys lacunosa* sp. nov.; 20, head, full face view, worker; 21, profile, worker; 22, apical fork of mandible, end-on view, worker; 23, head, full face view, female; 24, profile, female.

- 2.14 mm ..... *S. lichiaensis* sp. nov.
9. Numerous, long flagellate hairs on first gastral tergite; with propodeal teeth acute; propodeal lamellae well developed; in female, mesosoma in profile with scutum convex ..... *S. solifontis* Brown
- Sparse, long flagellate hairs on first gastral tergite (Fig. 16); propodeal teeth spongiform; in female, mesosoma in profile with scutum even (Fig. 19) ..... *S. hispida* sp. nov.

***Strumigenys formosensis* Forel (Figs. 3, 9)**

*Strumigenys feae* var. *formosensis* Forel, 1912. Entomol. Mitt. 1: 52.

*Strumigenys formosensis* Forel: Brown, 1949. Mushi 20: 19, 24.

**Material examined:** ILAN HSIEN: Fushan, 1 female, 8 workers, 10.X.1992, CCL; 16 workers, 10.X.1992, CCL; 1 female, 47 workers, 10.X.1992, CCL. KEELUNG CITY: Paomingsu, 1 worker, 16.V.1992, CCL. NANTOU HSIEN: Huisunlinchang, 3 females, 49 workers, 13.XII.1992, CCL; 5 workers, 14.XII.1992, CCL; 1 female, 20 workers, 14.XII.1992, CCL; 2 female, 75 workers, 14.XII.1992, CCL; 4 workers, 21.VI.1993, CCL; Lienhuachih, 11 workers, 13.XI.1992, CCL; Lushan, 2 workers, 17.X.1993, CCL. PINTUNG HSIEN: Kenting, 1 female, 80 workers, 25.IV.1992, CCL; 1 female, 75 workers, 25.IV.1992, CCL; 1 female, 98 workers, 25.IV.1992, CCL; 1 female, 57 workers, 26.IV.1992, CCL; 1 female, 10 workers, 26.IV.1992, CCL. TAIPEI CITY: Shuangchi, 1 female, 24 workers, 4.VIII.1988, CCL; TAIPEI HSIEN: Hsintien, 8 workers, 11.VI.1992, CCL; 15 workers, 13.VI.1992, CCL; 1 female, 1.X.1992, CCL; Wulai, 1 female, 22 workers, 2.X.1992, CCL. TAITUNG HSIEN: Chhipen, 6 workers, 5. XI.1994, CCL.

**Distribution:** Taiwan.

**Remarks:** This species is easily dis-

tinguished from the other Taiwanese congeners by the following combination of characters: (1) mandible sickle-like at extreme apex; (2) anterior border of clypeus deeply concave medially (Fig. 3); (3) cranium with numerous, short, broad spatulate hairs (Fig. 3). It is a pleistocene species of the genus in Taiwan, and widely distributed in the low-middle elevation zone of the island.

***Strumigenys godeffroyi* Mayr (Figs. 4, 10)**

*Strumigenys godeffroyi* Mayr, 1866. Sber. Akad. wiss. Wien 53: 516.

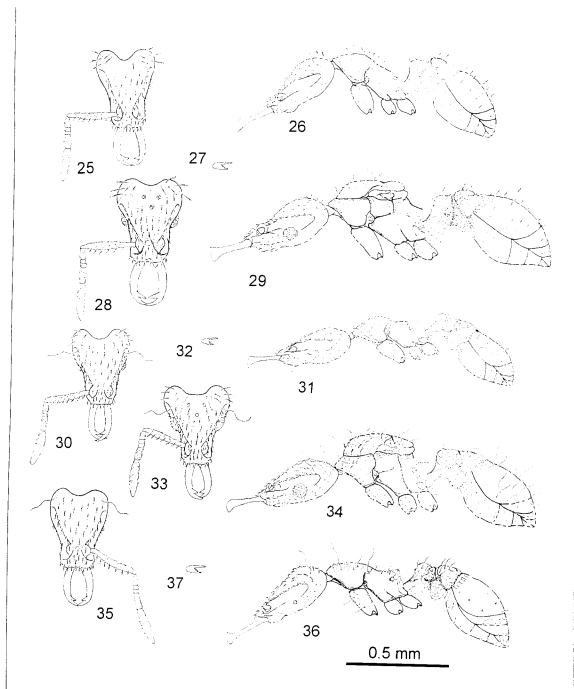
*Strumigenys godeffroyi* var. *indica* Forel, 1902. Rev. Suisse Zool. 10: 243.

*Strumigenys godeffroyi* var. *butteli* Forel, 1913. Zool. Jahrb. Syst. 36: 83.

**Material examined:** ILAN HSIEN: Fushan, 1 female, 59 workers, 10.X.1992, CCL; 3 females, 67 workers, 6.XI.1992, CCL; 3 females, 38 workers, 6.XI.1992, CCL; 2 females, 42 workers, 6.XI.1992, CCL; 1 female, 63 workers, 6.XI.1992, CCL; 1 worker, 10.VII.1993, CCL; 2 females, 24 workers, 27.II.1994, CCL; 1 female, 38 workers, 1.III.1994, CCL. NANTOU HSIEN: Huisunlinchang, 1 female, 14. XI. 1992, CCL. TAIPEI HSIEN: Chuchih, 2 workers, 13.VI.1992, CCL; 12 workers, 13. VI.1992, CCL; Hsintien, 2 workers, 4.V.1992, CCL; Wulai, 1 worker, 2.X.1992, CCL; Yinhotung, 2 females, 35 workers, 24.VII.1992, CCL.

**Distribution:** Fiji, Hawaiian Is., N. Australia, New Guinea, Philippine Is., S. India, Samoa, Solomon Is., Sri Lanka, Sunda Is., Taiwan (new record), Tonga, Vanuatu.

**Remarks:** This species resembles *S. lewisi* Cameron from Japan, Korea, China and Burma, *S. solifontis* Brown, and *S. liukueiensis* Terayama & Kubota from Taiwan in general appearance. However, it is distinguished from the latter 3 by the dorsum of promesonotum with 2 pairs of



Figs. 25-37. 25-29. *Strumigenys lichiaensis* sp. nov.; 25, head, full face view, worker; 26, profile, worker; 27, apical fork of mandible, end-on view, worker; 28, head, full face view, female; 29, profile, female. 30-34. *Strumigenys nanzanensis* sp. nov.; 30, head, full face view, worker; 31, profile, worker; 32, apical fork of mandible, end-on view, worker; 33, head, full face view, female; 34, profile, female. 35-37. *Strumigenys trada* sp. nov.; 35, head, full face view, worker; 36, profile, worker; 37, apical fork of mandible, end-on view, worker.



long flagellate hairs (Fig. 10). This is the 1st record of this species from Taiwan and is the northern limit in distribution of this species. This species is widely distributed from Australia through Oceania, Indonesia, and the Philippines, to South Asia.

***Strumigenys hispida* sp. nov. (Figs. 15-19)**

**Holotype Worker:** TL: 2.8 mm, HL: 0.73 mm, HW: 0.67 mm, SL: 0.45 mm, ML: 0.35 mm, FCD: 0.21 mm, PW: 0.34 mm, WL: 0.84 mm, CI: 92, MI: 48, SI: 67, FCI: 31, MSI: 40.

Head as in Fig. 15, microreticulate sculpture, with short, narrowly spatulate hairs on cranium. Posterior portion of head with a row of erect hairs. Mandible hook-like at extreme apex, slender in full face view; external margin very shallowly and evenly convex; internal margin almost straight. Preapical teeth of mandible prominently spiniform; apical fork with 2 spiniform teeth, and 2 intercalary denticles (Fig. 17). Anterior clypeal margin transverse. Antenna 6-segmented, in ratio of 13: 3: 1: 1: 3.5: 8.5 in length from base; scape microreticulate, with a row of narrowly spatulate hairs; 2nd segment 2 X as long as wide; 3rd and 4th segments each as long as wide; 5th segment 2 X as long as wide; apical segment 4.5 X as long as wide. Eye relatively small, 0.06 mm in maximum diameter, consisting of 8 ommatidia.

Dorsum of promesonotum microreticulate sculpture, with erect hairs present on dorsum of mesosoma (Fig. 16). Mesopleuron and metapleuron smooth and shining in most part. Propodeum microreticulate sculpture. Propodeal lamellae well developed.

Petiole peduncle long and node convex, microreticulate sculpture, with erect hairs. Spongiform appendages of pedicel segments well developed.

First gastral tergite smooth and shi-

ning, with sparse long flagellate hairs.

Body yellow.

**Paratype:** workers Ten paratype workers with the following measurements and indices: TL: 2.70-2.90 mm, HL: 0.71-0.74 mm, HW: 0.66-0.68 mm, SL: 0.44-0.47 mm, ML: 0.34-0.36 mm, FCD: 0.20-0.22 mm, PW: 0.33-0.35 mm, WL: 0.83-0.86 mm, CI: 90-93, MI: 46-49, SI: 63-67, FCI: 30-33, MSI: 39-42.

**Paratype females:** Five paratype females with the following measurements and indices: TL: 2.80-3.00 mm, HL: 0.74-0.75 mm, HW: 0.56-0.60 mm, SL: 0.41-0.43 mm, ML: 0.39-0.42 mm, FCD: 0.26-0.28 mm, PW: 0.38-0.39 mm, WL: 0.81-0.83 mm, CI: 78-80, MI: 51-53, SI: 70-72, FCI: 45-57, MSI: 46-48.

General shape of head and mesosoma as shown in Figs. 18-19. Head and antennal scape microreticulate sculpture. Head with narrowly spatulate hairs in cranium; posterior border of head with a row of erect hairs. Compound eye large. Ocelli relatively large, each with blackened callus.

Mesosoma in profile relatively more even dorsally, arching from anteriormost of mesonotum to posteriormost of metanotum (Fig. 19). Propodeal lamellae well developed. Dorsum of mesosoma with numerous, short erect hairs. Erect hairs sparsely present on dorsa of mesosoma, petiole, postpetiole and 1st gastral tergite.

Body yellow.

**Holotype:** Worker, NANTOU HSIEN: Chitou, 30.XI.1992, CCL.

**Paratypes:** CHIAI HSIEN: Fenchifu, 7 workers, 3.IX.1992, CCL. ILAN HSIEN: Fushan, 5 females, 58 workers, 9.X.1992, CCL. NANTOU HSIEN: Chitou, 1 female, 12 workers, 30.XI.1992, CCL (from the same nest as the holotype). TAIPEI HSIEN: Wulai, 1 worker, 2.X.1992, CCL.

**Type depository:** The holotype is preserved in the NTU, and paratypes in NTU and TARI.

**Distribution:** Taiwan.

**Etymology:** The species is named

from the Latin "hispidus", which means hair.

**Remarks:** This new species resembles *S. solifontis* Brown, but is distinguished from the latter by the lower number of hairs on the 1st gastral tergite, and much more developed propodeal lamellae. In female, mesosoma in profile is more even dorsally than that in *S. solifontis*.

***Strumigenys lacunosa* sp. nov. (Figs. 5, 11, 20-24)**

**Holotype Worker:** TL: 2.8 mm, HL: 0.73 mm, HW: 0.58 mm, SL: 0.4 mm, ML: 0.35 mm, FCD: 0.18 mm, PW: 0.40 mm, WL: 0.82 mm, CI: 80, MI: 49, SI: 69, FCI: 32, MSI: 49.

Head as in Figs. 5 and 20, lacunose sculpture, with flocculent hairs on cranium; in full face view, dorsolateral borders of head posteriorly with 3 pairs of long flagellate hairs. Mandible hook-like at extreme apex, slender in full face view, external margin convex very shallowly and evenly, internal margin almost straight; preapical teeth of mandible prominently spiniform or reduced (Fig. 5); apical fork with 2 spiniform teeth, with an intercalary denticle (Fig. 22). Anterior clypeal margin transverse. Antenna 6-segmented, in ratio of 10: 1.5: 1: 1: 2.5: 7 in length from base; scape lacunose, with flagellate hairs; 2nd segment 1.2 X as long as wide; 3rd and 4th segments each shorter than broad; 5th segment 2 X as long as wide; apical segment 3.3 X as long as wide. Eye relatively small, 0.06 mm in maximum diameter, consisting of 13 ommatidia.

Dorsum of promesonotum with lacunose sculpture, and with flocculent hairs and 2 pairs of long flagellate hairs (Fig. 11). Mesopleuron and metapleuron smooth and shining in most part. Propodeum with lacunose sculpture. Propodeal teeth acute and well developed; lamellae weakly developed.

Petiole peduncle long and node weak-

ly developed, with lacunose sculpture and with long flagellate hairs. Spongiform appendages of pedicel segments well developed.

First gastral tergite smooth and shining with numerous, long flagellate hairs

Body reddish brown.

**Paratype workers:** Forty-three paratype workers with the following measurements and indices: TL: 2.80-3.00 mm, HL: 0.70-0.75 mm, HW: 0.58-0.60 mm, SL: 0.40-0.41 mm, ML: 0.35-0.36 mm, FCD: 0.18-0.20 mm, PW: 0.39-0.41 mm, WL: 0.82-0.84 mm, CI: 77-86, MI: 47-51, SI: 67-71, FCI: 30-34, MSI: 46-49.

**Paratype females:** Two paratype females with the following measurements and indices: TL: 3.36-3.38 mm, HL: 0.78-0.82 mm, HW: 0.70-0.72 mm, SL: 0.45-0.46 mm, ML: 0.36-0.37 mm, FCD: 0.22-0.23 mm, PW: 0.50-0.51 mm, WL: 1.00-1.02 mm, CI: 85-92, MI: 44-47, SI: 63-66, FCI: 31-32, MSI: 50.

General shape of head and mesosoma as shown in Figs. 23-24. Head and antennal scapes with lacunose sculpture, flocculent hairs on cranium; dorsolateral borders of head posteriorly with 3 pairs of long flagellate hairs in full face view. Compound eye large. Ocelli relatively large, each with blackened callus.

Mesosoma in profile moderately convex dorsally, arching from anteriormost of mesonotum to posteriormost of metanotum (Fig. 24). Propodeal teeth acute, well developed; lamellae weakly developed. Dorsum of mesosoma with flocculent hairs. Long flagellate hairs present on dorsa of mesosoma, petiole, postpetiole and 1st gastral tergite.

Body reddish brown.

**Holotype:** Worker, TAIPEI HSIEN: Chuchih, 26.V.1988, CCL.

**Paratypes:** NANTOU HSIEN: Chitou, 1 female, 32 workers, 29.XI.1992, CCL; Lienhuachih, 1 worker, 31.X.1988, YCS. TAIPEI HSIEN: 1 female, 9 workers, 26.V.1988, CCL (from the same nest as the holotype). TAITUNG HSIEN: Li-

chia, 1 worker, 29.III.1995, CCL.

**Type depository:** The holotype is preserved in the NTU, and paratypes in NTU and TARI.

**Distribution:** Taiwan.

**Etymology:** The name of the new species refers to the lacunose sculptures on the head, mesosoma, petiole and postpetiole.

**Remarks:** This species is easily distinguished from the other known species of the genus by the lacunose sculpture and flocculent hairs on the head, mesosoma, petiole and postpetiole. In different nests this species had 2 mandible-types in the preapical tooth, either spiniform or reduced.

***Strumigenys lichiaensis* sp. nov. (Figs. 25-29)**

**Holotype Worker:** TL: 2.10 mm, HL: 0.63 mm, HW: 0.49 mm, SL: 0.44 mm, ML: 0.31 mm, FCD: 0.18 mm, PW: 0.29 mm, WL: 0.66 mm, CI: 78, MI: 49, SI: 90, FCI: 37, MSI: 44.

Head as in Fig. 25, microreticulate sculpture, with short, narrowly spatulate hairs on cranium. Posterior and dorsolateral borders of head posteriorly with slightly clavate erect hairs. Mandible hook-like at extreme apex, slender in full face view; external margin very shallowly and evenly convex, internal margin almost straight. Preapical teeth of mandible prominently spiniform; apical fork with 2 spiniform teeth and 2 intercalary denticles (Fig. 27). Anterior clypeal margin transverse. Antenna 6-segmented, in ratio of 15: 2.7: 1: 1: 5: 11 in length from base; scape microreticulate, with a row of narrowly spatulate hairs; 2nd segment 1.2 X as long as wide; 3rd and 4th segments each shorter than broad; 5th segment 2.5 X as long as wide; apical segment 3.6 X as long as wide. Eye relatively small, 0.07 mm in maximum diameter, consisting of 13 ommatidia.

Dorsum of promesonotum microre-

ticulate sculpture, with short, narrowly spatulate hairs. Stout slightly clavate hairs present on the dorsum of mesosoma (Fig. 26). Mesopleuron and metapleuron smooth and shining in most part. Propodeum microreticulate sculpture. Propodeal lamellae well developed.

Petiole peduncle long and node convex, microreticulate sculpture, with stout erect hairs. Spongiform appendages of pedicel segments well developed.

First gastral tergite smooth and shining with numerous, stout and slightly clavate erect hairs.

Body yellow.

**Paratype workers:** One paratype worker with the following measurements and indices: TL: 2.14 mm, HL: 0.64 mm, HW: 0.49 mm, SL: 0.45 mm, ML: 0.31 mm, FCD: 0.19 mm, PW: 0.29 mm, WL: 0.66 mm, CI: 77, MI: 48, SI: 92, FCI: 39, MSI: 44.

**Paratype female:** One paratype female with the following measurement and indices: TL: 2.78 mm, HL: 0.68 mm, HW: 0.54 mm, SL: 0.47 mm, ML: 0.32 mm, FCD: 0.23 mm, PW: 0.38 mm, WL: 0.82 mm, CI: 78, MI: 47, SI: 87, FCI: 43, MSI: 46.

General shape of head and mesosoma as shown in Figs. 28-29. Head and antennal scapes microreticulate sculpture. Head with narrowly spatulate hairs on cranium; posterior and dorsolateral borders of head posteriorly with numerous, slightly clavate erect hairs. Compound eye large. Ocelli relatively large, each with blackened callus.

Mesosoma in profile relatively more even dorsally, arching from the anteriormost of mesonotum to posteriormost of metanotum (Fig. 29). Propodeal lamellae well developed. Dorsum of mesosoma with numerous, short erect hairs. Stout and slightly clavate erect hairs present on dorsa of mesosoma, petiole, postpetiole and 1st gastral tergite.

Body yellow.

**Holotype:** Worker. TAITUNG HSIEN: Lichia, 24.IV. 1995, CCL.

**Paratypes:** TAITUNG HSIEN: Lichia, 1 female, 1 worker, 24.IV. 1995, CCL (from the same nest as the holotype).

**Type depository:** The types are preserved in the NTU.

**Distribution:** Taiwan.

**Etymology:** Named after Lichia, the type locality of this new species.

**Remarks:** This new species resembles *S. liukueiensis* Terayama & Kubota from Taiwan. Both species are easily separated from the other Taiwanese congeners by the presence of numerous, stout erect hairs on dorsa of mesosoma and 1st gastral tergite. It is distinguished from the latter by the relatively small size in worker (TL < 2.2 mm in *lichiaensis*, TL > 2.5 mm in *liukueiensis*) and the absence of erect hairs on the frontal area of head in worker and female.

***Strumigenys liukueiensis* Terayama & Kubota (Figs. 6, 12)**

*Strumigenys liukueiensis* Terayama & Kubota, 1989. Jap. J. Entomol. 57: 785.

**Material examined:** KEELUNG CITY: Paomingsu, 2 workers, 26.VI. 1992, CCL.

**Distribution:** Taiwan.

**Remarks:** The species resembles *S. solifontis* Brown from Taiwan and Japan. However, it is distinguished from *solifontis* (Figs. 8, 14) by the head and mesosoma with much more abundant, long erect hairs (Figs. 6, 12) and in female, the dorsal outline of mesosoma in profile relatively more even.

***Strumigenys minutula* Terayama & Kubota (Fig. 7)**

*Strumigenys minutula* Terayama & Kubota, 1989. Jap. J. Entomol. 57: 782

**Material examined:** KAOHSIUNG HSIEN: Maolin, 1 female, 87 workers, 19. XII. 1992, CCL. PINTUNG HSIEN: Chia-

leshui, 2 females, 33 workers, 18.XII. 1992, CCL. TAITUNG HSIEN: Lanyu, 10 workers, 6.XI. 1989, YCS.

**Distribution:** Taiwan, Japan.

**Remarks:** The species is easily distinguished from the other known species of the genus by its small size (TL 1.70-1.96 mm in worker caste) and relatively short and strongly arcuate mandibles (Fig. 7). This species is distributed in Taiwan and Lanyu (Orchid Is.).

***Strumigenys nanzanensis* sp. nov. (Figs. 13, 30-34)**

**Holotype Worker:** TL: 2.22 mm, HL: 0.60 mm, HW: 0.47 mm, SL: 0.38 mm, ML: 0.27 mm, FCD: 0.18 mm, PW: 0.32 mm, WL: 0.62 mm, CL: 78, MI: 45, SI: 81, FCI: 38, MSI: 52.

Head as in Fig. 30, microreticulate sculpture, with short, narrowly spatulate hairs on cranium; in full face view, dorsolateral borders of head posteriorly with a pair of long flagellate hairs. Mandible hook-like at extreme apex, slender in full face view, external margin convex very shallowly and evenly, internal margin almost straight. Preapical teeth of mandible prominently spiniform; apical fork with 2 spiniform teeth and an intercalary denticle (Fig. 32). Anterior clypeal margin transverse. Antenna 6-segmented, in ratio of 15: 2.7: 1: 1: 5: 11 in length from base; scape microreticulate, with a row of narrowly spatulate hairs; 2nd segment 1.2 X as long as wide; 3rd and 4th segments each shorter than broad; 5th segment 2.5 X as long as wide; apical segment 3.6 X as long as wide. Eye relatively large, 0.08 mm in maximum diameter, consisting of 30 ommatidia.

Dorsum of promesonotum microreticulate sculpture, with numerous, short curved hairs and narrowly spatulate hairs (Fig. 13). Long flagellate hairs present on dorsum of mesosoma (Fig. 31). Mesopleuron and metapleuron smooth and shining in most part. Propodeum with

microreticulate sculpture. Propodeal lamellae well developed; posterodorsal corner rounded, not forming angle in lateral view.

Petiole peduncle long and node convex, microreticulate sculpture, with long flagellate hairs. Spongiform appendages of pedicel segments well developed.

First gastral tergite smooth and shining with numerous, long flagellate hairs. Body yellow.

**Paratype workers:** Six paratype workers with the following measurements and indices: TL: 2.20-3.22 mm, HL: 0.60-0.63 mm, HW: 0.46-0.47 mm, SL: 0.37-0.38 mm, ML: 0.27-0.28 mm, FCD: 0.18-0.20 mm, PW: 0.30-0.32 mm, WL: 0.60-0.63 mm, CI: 73-78, MI: 43-47, SI: 79-83, FCI: 38-39, MSI: 49-52.

**Paratype females:** Three paratype females with the following measurements and indices: TL: 2.55-2.58 mm, HL: 0.63-0.64 mm, HW: 0.55-0.55 mm, SL: 0.40-0.41 mm, ML: 0.32-0.34 mm, FCD: 0.18-0.19 mm, PW: 0.37-0.40 mm, WL: 0.78-0.79 mm, CI: 86-87, MI: 51-53, SI: 72-74, FCI: 33-34, MSI: 47-51.

General shape of head and mesosoma as shown in Figs. 33-34. Head and antennal scape microreticulate sculpture. Head with narrowly spatulate hairs on cranium; in full face view, dorsolateral borders of head posteriorly with a pair of long flagellate hairs. Compound eye large. Ocelli relatively large, each with blackened callus.

Mesosoma in profile more convex dorsally, arching from anteriormost of mesonotum to posteriormost of metanotum (Fig. 34). Propodeal lamellae well developed. Dorsum of mesosoma with numerous, short curved hairs and narrowly spatulate hairs. Long flagellate hairs present on the dorsa of mesosoma, petiole, postpetiole and 1st gastral tergite.

Body yellow.

**Holotype:** Worker, PINTUNG HSIEN: Nanzanshan, 17.XII.1992, CCL.

**Paratypes:** PINTUNG HSIEN: Na-

nzanshan, 3 females, 6 workers, 17.XII.1992, CCL (from the same nest as the holotype).

**Type depositary:** The holotype is preserved in the NTU, and paratypes in NTU and TARI.

**Distribution:** Taiwan.

**Etymology:** Named after Nanzanshan, the type locality.

**Remarks:** This new species resembles *S. minutula* Terayama & Kubota from Taiwan and Japan. However, it is distinguished from the latter by the mesosoma with much more abundant, short narrowly spatulate hairs and the almost straight mandibular shafts. In female, dorsal outline of mesosoma in profile is more strongly convex than that of *S. minutula*.

### ***Strumigenys solifontis* Brown (Figs. 8, 14)**

*Strumigenys solifontis* Brown, 1949. Mushi 20: 18.

#### **Material examined:** HUALIEN

HSIEN: Liyuchih, 2 females, 18 workers, 12.XI.1994, CCL. ILAN HSIEN: Fushan, 1 worker, 10.VII.1991, CCL; Nanao, 1 worker, 7. VIII.1992, CCL. KAOHSIUNG HSIEN: Chuyunshan, 7 workers, 24.I.1994, CCL. Shanping, 6 workers, 9.V.1992, CCL. KEELUNG City: Paomingsu, 6 workers, 26. VI.1992, CCL. NANTOU HSIEN: Chitou, 2 females, 86 workers, 29.XI.1992, CCL; Lienhuachih, 12 workers, 10.VII.1992, CCL; 6 females, 24 workers, 12.XI.1992, CCL; 1 female, 20 workers, 12.XI.1992, CCL; 4 females, 29 workers, 12.XI.1992, CCL; 2 females, 23 workers, 12.XI.1992, CCL; 2 females, 47 workers, 12.XI.1992, CCL; 1 female, 54 workers, 30.XI.1992, CCL. Nanshanchi, 1 female, 15 workers, 9. V.1994, CCL. TAICHUNG HSIEN: Chiapaotai, 1 worker, 16.V.1992, ISS. TAIPEI HSIEN: Chiuhsinglin, 1 female, 2 workers, 2.VI.1992, CCL; Chuchih, 1 worker, 26.II.1992, CCL; 19 females, 68 workers, 1.

X.1992, CCL; Hsintien, 7 workers, 4.V.1992, CCL; 6 workers, 4.V.1992, CCL; 6 workers, 4.V.1992, CCL; 8 workers, 4.V.1992, CCL; 3 workers, 4.V.1992, CCL; 1 female, 4 workers, 11.VI.1992, CCL; 2 females, 45 workers, 24.VII.1992, CCL; 1 female, 22 workers, 24.VII.1992, CCL; Wulai, 12 females, 16 workers, 2.X.1992, CCL; 1 worker, 2.X.1992, CCL; 2 workers, 9.IX.1994, CCL, TAITUNG HSIEN: Chhipen, 1 female, 9 workers, 5.XI.1994, CCL; Chinsuiying, 2 females, 10 workers, 19.IV.1994, CCL; Hsinchangshan, 1 female, 12 workers, 27.IV.1994, CCL; Lichia, 3 workers, 28.III.1994, CCL; Yenping, 3 workers, 29.VII.1992, CCL; 9 workers, 29.VII.1992, CCL; 18 workers, 29.VII.1992, CCL; 4 workers, 31.VII.1992, CCL; 1 female, 5 workers, 29.VII.1992, CCL. TAOYUAN HSIEN: Hsiaowulai, 2 workers, 29.IX.1994, CCL.

**Distribution:** Taiwan, Japan.

**Remarks:** As *S. formosensis*, this species is a pleistoendemic species of the genus in Taiwan and widely distributed on the island.

***Strumigenys trada* sp. nov. (Figs. 35-37)**

**Holotype Worker:** TL: 2.27 mm, HL: 0.66 mm, HW: 0.46 mm, SL: 0.42 mm, ML: 0.31 mm, FCD: 0.20 mm, PW: 0.28 mm, WL: 0.66 mm, CI: 70, MI: 47, SI: 91, FCI: 43, MSI: 42.

Head as in Fig. 35, microreticulate sculpture, with short, narrowly spatulate hairs on cranium; in full face view, dorsolateral borders of head posteriorly with a pair of long flagellate hairs in full face view. Mandible hook-like at extreme apex, slender in full face view, external margin very shallowly and evenly convex; internal margin almost straight. Preapical teeth of mandible prominently spiniform; apical fork with 2 spiniform teeth and 2 intercalary denticles (Fig. 37). Anterior clypeal margin transverse. Antenna 6-se-

gmented, in ratio of 15: 3.2: 1: 1: 4.8: 11 in length from base; scape microreticulate, with a row of narrowly spatulate hairs; 2nd segment 2 X as long as wide; 3rd and 4th segments each shorter than broad; 5th segment 2.8 X as long as wide; apical segment 5 X as long as wide. Eye relatively small, 0.04 mm in maximum diameter, consisting of 6 ommatidia.

Dorsum of pronotum smooth and shining in most part and with sparse, short curved hairs and narrowly spatulate hairs. Two pairs of long flagellate hairs present on dorsum of pronotum (Fig. 36). Mesopleuron, metapleuron and metanotum smooth and shining in most part. Propodeal lamellae well developed; posterior border straight and posterodorsal corner dull angulate in lateral view.

Petiole peduncle long and node convex, microreticulate sculpture, with erect hairs. Spongiform appendages of pedicel segments well developed.

First gastral tergite smooth and shining with more than 5 pairs of erect hairs.

Body yellowish brown.

**Holotype:** Worker, TAIPEI HSIEN, Wulai, 2.X.1992, CCL.

**Type depositary:** The holotype is preserved in the NTU.

**Distribution:** Taiwan.

**Etymology:** The species is named from the Latin "trade", which means change.

**Remarks:** This new species is closely related to *S. godeffroyi* Mayr, but is separable from it by the following characters: (1) smaller size (TL > 2.35 mm in *godeffroyi*, TL > 2.22 mm in *trada*); (2) pronotum, mesonotum and propodeum smooth and shining in most part (microreticulate in *godeffroyi*); (3) 1st gastral tergite without long flagellate hairs, erect hairs present (with about 7 pairs of hairs in *godeffroyi*); (4) eye relatively small and consisting of 6 ommatidia (more than 10 ommatidia in *godeffroyi*). Only 1 specimen was collected from Wulai in

northern Taiwan.

## Acknowledgments

We wish to thank Dr. B. Bolton, British Museum of Natural History, and Dr. M. Terayama, University of Tokyo, for reviewing the manuscript. This work was funded by the National Science Council, Republic of China (NSC-82-0409-B-002-070 & NSC-84-2321-B-002-119).

## References

- Bolton, B.** 1983. The Afrotropical dacetidine ants (Formicidae). *Bull. Br. Mus. Nat. Hist. (Entomol.)* 46: 267-416.
- Bolton, B.** 1995. A taxonomic and zoogeographical census of the extant ant taxa (Hymenoptera: Formicidae). *J. Natur. Hist.* 29: 1037-1056.
- Brown, W. L., Jr.** 1948. A preliminary generic revision of the higher Dacetini. *Trans. Amer. Entomol. Soc.* 74: 101-109.
- Brown, W. L., Jr.** 1949. Revision of the ant tribe Dacetini. I. Fauna of Japan, China and Taiwan. *Mushi* 20: 1-25.
- Brown, W. L., Jr.** 1953. Revisionary studies in the ant tribe Dacetini. *Amer. Midl. Natur.* 50: 1-137.
- Brown, W. L., Jr.** 1954. The ant genus *Strumigenys* Fr. Smith in the Ethiopian and Malagasy regions. *Bull. Mus. Comp. Zool. Harvard College* 112: 1-34.
- Brown, W. L., Jr.** 1956. The Indo-Australian species of the ant genus *Strumigenys* Fr. Smith: three new Philippine species. *Psyche* 63: 113-118.
- Brown, W. L., Jr.** 1959. The Indo-Australian species of the ant genus *Strumigenys* Fr. Smith: group of *S. godeffroyi* in Borneo. *Psyche* 65: 81-89.
- Brown, W. L., Jr.** 1973. The Indo-Australian species of the ant genus *Strumigenys*: groups of *horvathi*, *mayri* and *wallacei*. *Pacif. Insects* 15: 259-269.
- Brown, W. L. Jr., and E. O. Wilson.** 1959. The evolution of the dacetidine ants. *Quart. Rev. Biol.* 34: 278-294.
- Diussky, G. M.** 1994. Ants (Hymenoptera, Formicidae) of Fiji, Tonga, Samoa and the problem of formation of island fauna. *Entomol. Rev.* 73: 110-122.
- Forel, A.** 1912. H. Sauter's Formosa-Ausbeute. Formicidae (Hymenoptera). *Entomol. Mitt.* 1: 45-61, 67-81.
- Terayama, M., and S. Kubota.** 1989. The ant tribe Dacetini (Hymenoptera: Formicidae) of Taiwan, with descriptions of three new species. *Jap. J. Entomol.* 57: 778-792.
- Wheeler, W. M.** 1929. Ants collected by Professor F. Silvestri in Formosa, the Malay Peninsula and the Philippines. *Boll. Lab. Zool. Gen. Agrar. Portici* 24: 27-64.

Received for publication June 22, 1996;

Revised manuscript accepted August 19, 1996.

# 台灣產瘤顎蟻屬（膜翅目：蟻科）

林宗岐 吳文哲\* 國立台灣大學植物病蟲害學系 台北市羅斯福路四段1號

## 摘 要

瘤顎蟻屬(*Strumigenys*)隸膜翅目、蟻科、家蟻亞科、針刺家蟻族，全世界已知種類167種。本文修訂台灣產種類共計10種，其中包括5種新種和1種新記錄種：*S. formosensis* Forel, *S. godeffroyi* Mayr(新記錄), *S. hispida* sp. nov., *S. lacunosa* sp. nov., *S. lichiaensis* sp. nov., *S. liukueiensis* Terayama & Kubota, *S. minutula* Terayama & Kubota, *S. nanzanensis* sp. nov., *S. solifontis* Brown及*S. trada* sp. nov.。文中並附職蟻和蟻后分種檢索表。

**關鍵詞：**膜翅目、蟻科、針刺家蟻族、瘤顎蟻屬、台灣。